SPECIAL CENTER FOR BEAM PHYSICS SEMINAR

"Ultrafast Pulse Radiolysis"

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Wednesday, March 21, 2001, 10:30 AM
Bldg. 71 Conference Room, LBNL
Please note special day of week

Summary:

Operation of accelerators at ever-higher gradients yields The development of subpicosecond pulse radiolysis techniques will be an important technological advancement for radiation chemical studies. Experiments utilizing subpicosecond time resolution will allow the direct observation of the complex chemical and physical processes that are produced by ionizing radiation. For example, consider a study of the subpicosecond thermalization of electrons that are produced by the ionization of liquid water. Knowledge of these kinetics upon electron radiolysis would provide valuable insight into the microscopic factors that influence the ensuing chemical reactions. At present, the available information about electron thermalization has come from laser photionization studies. Work performed in our group shows that laser photoionization does not occur by the same mechanism as in electron radiolysis. We have begun exploring the possibility of using laser-based table-top electron generation for chemical studies. Through a collaboration with the Umstadter group at the University of Michigan we have demonstrated that the charge produced by a laser based accelerator is sufficient to produce a measurable quantity of chemical transients. We are also developing sensitive methods for measuring transient absorption spectra on a single shot basis. The absorption measurements will allow the study of ultrafast energy deposition and structure determination of reaction intermediates that are associated with radiation induced chemical events. In our lab we have begun construction of a Terawatt Ultrafast High Field Facility (TUHFF) that will provide a source of tunable femtosecond soft x-rays and electron pulses for chemical studies. Currently, the construction of an ultrafast laser that will be capable of delivering peak powers in excess of 20x1012W (i.e., 1J in 50fs) is nearing completion. Our laser system is designed to operate at a 10Hz repetition rate.

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